GLACIAL ROCK SLIDING

F. O. JONES

A geological curiosity in the shape of a displaced mass of rock resulting from ice-pressure during the glacial invasion has been partially uncovered in the Voight quarry, three miles north of Elmira, N. Y., and one-half mile south of Latta Brook ravine. Reference may be had to the Elmira sheet of the United States Geological Survey, but the contour lines represent the topography only in a general way.

The quarry is located in the face of a ledge which extends out some 300 feet from the main hill. At its southern end the cutting is only 37 feet deep, but the linear extent is nearly 400 feet. The bottom is about 35 feet above the valley level, making the present approximate height of the point 70 feet.

Massive sandstones form the bottom of the quarry, but they rapidly thin out, and the upper third is very largely composed of shale. This formation has received the local name "High Point sandstones."[1] The strata have a northward dip of about 50 feet per mile, and their position indicates that the axial inclination of the Elmira anticline, to which they belong, is fully as great eastward. Their position was, therefore, an important factor in the amount of pressure required to move the load.

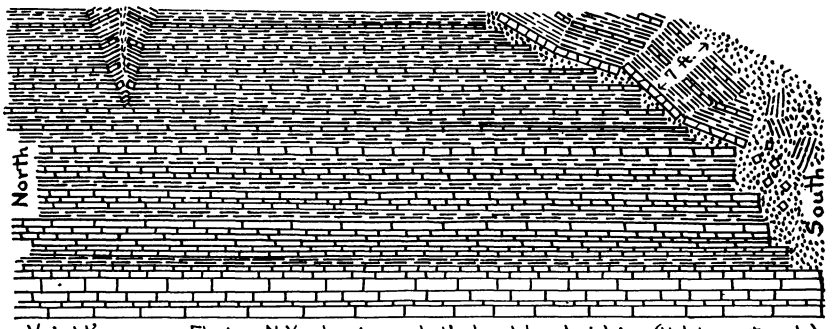
The south side of the ledge is in the form of steps or small terraces, which remain as they were in preglacial times, and it is down over this serrated slope that the rock mass was shoved. Its present form is indicated much more clearly by the accompanying sketch than it could be by a detailed description. The base or shoe on which the slide occurred is a hard, blocky sandstone 12 inches thick, and it is chiefly owing to this fact that its character can be recognized.

Any attempt to delimit the slide must be largely conjectural, owing to the till covering. There are 50 feet of the basal sandstone in sight, and at one point 7 feet of shale and thin sandstones remain

[1] Museum Bulletin No. 81, *Watkins and Elmira Quadrangles* (Albany, N. Y., 1905).

in place on it, which would make 8 feet the minimum thickness. The width and length could hardly have been less than 100 feet each, or a total of 80,000 cubic feet. It is probable, however, that the original dimensions considerably exceeded the figures given.

A further evidence of the pressure exerted by the ice is a V-shaped fault in the face of the quarry 90 feet north of the slide. The first noticeable disturbance of the strata is just above a 6-inch sandstone. From that point the width of the fault regularly increases until the top of the exposure is reached (11 feet), where the width is 7 feet and the vertical throw about 20 inches. The 6-inch sandstone can be traced northward from the fault for more than 200 feet, and the



Voight's quarry, Elmira, N.Y., showing rock displaced by glacial ice. (Not drawn to scale).

whole amount of rock moved may have approximated half a million cubic feet.

Although rare, Voight's quarry does not contain the only preserved example of glacial rock-sliding. Another instance occurs in an old quarry at Pine Valley, some six miles farther north and on the western side of the valley. It was first noticed by Professor James Hall, and by him described as follows in the *Third Annual Report of the Fourth Geological District:*[1]

> At the last-named quarry I observed the singular fact of non-conformable strata, as yet the only instance noticed, and which various circumstances seem to render incredible. The strata are parts of the same mass, once continuous, the lower dipping south at an angle of four or five degrees, and the upper dipping north at about the same angle; and a short distance farther south the whole mass

[1] Albany, N. Y., 1839.

dips north. The only explanation that now offers is that at the time the rocks were subjected to the force which produced the undulations the upper part slipped over the lower and at this point partook of the elevation south, while the lower was affected only by the uplifting to the north.

It is not strange that Professor Hall should have failed to divine the cause of the stratigraphical disturbance since Pleistocene geology was then an undeciphered branch of the science. It is somewhat remarkable, however, that modern geologists have not commented upon this interesting phenomenon of the glacial invasion—interesting because it illustrates the great pressure sometimes exerted, and because it has a distinct bearing on that much-controverted theory of ice-erosion.